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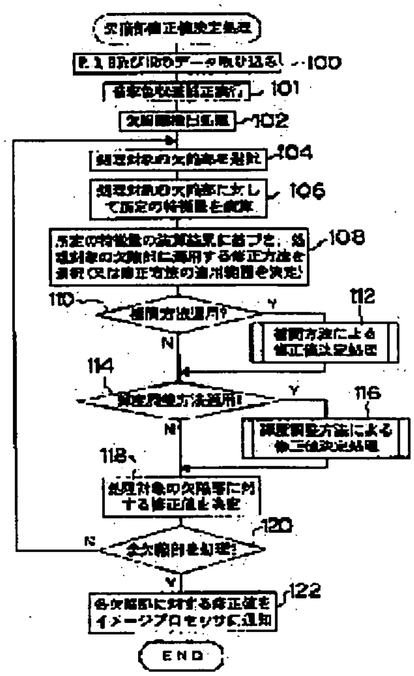
(54) METHOD AND DEVICE FOR PICTURE PROCESSING AND RECORDING MEDIUM

(57)Abstract:
PROBLEM TO BE SOLVED: To correct various defective parts with high precision.
SOLUTION: A picture recorded ON A photographic film is read with respect to R, G, B, and IR, and chromatic aberration of magnification of each data of R, G, B, and IR is corrected (101), and thereafter, a defective part of the picture as the processing object is detected based on data of IR (102), and a prescribed feature quantity is calculated for the defective part of the processing object (106), and an interpolation method or a luminance adjustment method is selected as the correction method for the defect of the processing object based on the calculation result, and application ranges of both correction methods are determined (108). After one or both of correction methods are applied to determine a correction value (110 to 116), the final correction value is determined (118).



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CLAIMS

[Claim(s)]
[Claim 1] An image processing system characterized by providing the following A detection means to detect a defective part of an image which image information expresses A decision means to determine each applicability of two or more correction methods which choose a correction method which should be applied to correction of a defective part from two or more sorts of correction methods based on characteristic quantity of a defective part, or are applied to correction of a defective part, A correction means which corrects a defective part to said image information with the application of a correction method chosen by said decision means, or is in applicability determined by said decision means, applies said two or more correction methods respectively, and corrects a defective part
[Claim 2] It is the image processing system according to claim 1 characterized by detecting a defective part of said image from a result of having carried out photo electric conversion of the non-light which said image information expressed an image recorded on an image recording material, and said detection means irradiated the non-light at said image recording material with which said image was recorded, and penetrated or reflected an image recording material.
[Claim 3] Correlation of concentration change for every component color in near the defective part of an image with which image information expresses said decision means as characteristic quantity of said defective part, [whether distribution of concentration in a field around a defective part of said image and a defective part exist in a principal part field in said image, and] And an image processing system according to claim 1 characterized by making selection of said correction method which should be applied, or a decision of said applicability using at least one of the duplication rates with said principal part field of a defective part.
[Claim 4] Transparency of the non-light in near [said] a defective part when said decision means irradiates the non-light as characteristic quantity of said defective part at said image recording material, or change of the amount of reflected lights, Transparency of the light in near [said] the defective part when irradiating the light at said image recording material, or correlation of change of the amount of reflected lights, And an image processing system according to claim 2 characterized by making selection of said correction method which should be applied, or a decision of said applicability using either [at least] transparency of the non-light in near [said] a defective part, or the amount of reflected lights.
[Claim 5] An image processing system according to claim 1 characterized by including [two or more] said interpolation method of asking a correction method of a seed for information on a defective part with interpolation from information on a field around this defective part, and a brilliance-control method which corrects image information so that brightness of a defective part may change.
[Claim 6] When said image recording material is irradiated respectively, said decision means the non-light and light of two or more predetermined wavelength regions in a visible region About the non-light, the amount of transmitted lights in a defective part is lower than the amount of transmitted lights in a field around said defective part. About light of at least one wavelength region in said two or more wavelength regions An image processing system according to claim 2 characterized by choosing a interpolation method of searching for information on a defective

part with interpolation from information on a field around this defective part, as the correction method which should be applied to correction of a defective part when the amount of transmitted lights in said defective part is higher than the amount of transmitted lights in a field of said perimeter.
[Claim 7] When said image recording material is irradiated respectively, said decision means the non-light and light of two or more predetermined wavelength regions in a visible region When the amount of transmitted lights in said defective part is lower than the amount of transmitted lights in a field around said defective part about both the non-light and light of two or more of said wavelength regions An image processing system according to claim 2 characterized by choosing a brilliance-control method which corrects image information as the correction method which should be applied to correction of a defective part so that brightness of a defective part may change.
[Claim 8] An image processing system characterized by providing the following A characteristic quantity operation means to calculate image characteristic quantity respectively to a defective part which exists in an image which image information expresses along two or more mutually different directions out of this defective part An individual adjusted value operation means to perform respectively calculating with interpolation an adjusted value for correcting said defective part from information on a field which exists in the predetermined direction on an image to said defective part about said two or more directions A last adjusted value operation means to calculate the last adjusted value based on image characteristic quantity for every direction calculated with said characteristic quantity operation means from an adjusted value calculated for every direction with said individual adjusted value operation means A correction means which corrects said defective part to said image information using the last adjusted value calculated with said last adjusted value operation means
[Claim 9] Concentration change of said image with which said characteristic quantity operation means met in the predetermined direction as said image characteristic quantity, Quantity of light change which met in the predetermined direction of the non-light which penetrated or reflected an image recording material when irradiating the non-light in an image recording material with which an image which said image information expresses was recorded, The number of defective pixels which exist on said image in fixed distance along a predetermined direction, And an image processing system according to claim 8 characterized by thing of distance ** until a normal pixel which does not belong to a defective part when said image is followed along a predetermined direction appears for which it calculates at least any they are respectively about said two or more directions.
[Claim 10] Either [at least] said characteristic quantity operation means or an individual adjusted value operation means is the image processing system according to claim 8 characterized by performing respectively calculating said image characteristic quantity or said adjusted value in the range until a fixed number of normal pixels which do not belong to a defective part appear when said image is followed along the predetermined direction about said two or more directions.
[Claim 11] An image processing system characterized by providing the following Transparency or the amount of reflected lights of the non-light in near [said] the defective part when irradiating the non-light at said image recording material to a defective part of said image detected from image information showing an image recorded on an image recording material A correction means by which brightness of said defective part of an image which said image information expresses as an operation means to calculate the amount of brightness modification for correcting said defective part based on a difference of a refractive index of the light in an image recording material and the non-light corrects image information so that only brightness variation calculated with said operation means may change
[Claim 12] Said operation means as characteristic quantity showing a difference of a refractive index of the light in an image recording material and the non-light A value which extracted a high frequency component from transparency of the non-light in near [said] the defective part when irradiating the non-light at said image recording material, or change of the amount of reflected lights, An image processing system according to claim 11 characterized by calculating a ratio of

a value and ** which extracted a high frequency component from transparency of the light in near the defective part when irradiating the light at an image recording material, or change of the amount of reflected lights, or acquiring said characteristic quantity based on a class of image recording material.

[Claim 13] Detect a defective part of an image which image information expresses, and it is based on characteristic quantity of a defective part. [whether a correction method which should be applied to correction of a defective part is chosen from two or more sorts of correction methods, and] Or an image-processing method which determines each applicability of two or more correction methods applied to correction of a defective part, corrects a defective part with the application of said selected correction method to said image information, or is in said determined applicability, applies said two or more correction methods respectively, and corrects a defective part.

[Claim 14] While calculating image characteristic quantity respectively to a defective part which exists in an image which image information expresses along two or more mutually different directions out of this defective part It performs respectively calculating with interpolation an adjusted value for correcting said defective part from information on a field which exists in the predetermined direction on an image to said defective part about said two or more directions. An image-processing method which calculates the last adjusted value from an adjusted value for said every direction, and corrects said defective part to said image information using said last adjusted value based on image characteristic quantity for said every direction.

[Claim 15] Transparency or the amount of reflected lights of the non-light in near [said] the defective part when irradiating the non-light at said image recording material to a defective part of said image detected from image information showing an image recorded on an image recording material, It is based on a difference of a refractive index of the light in an image recording material and the non-light. An image-processing method which corrects image information so that only brightness variation which calculated the amount of brightness modification for correcting said defective part, and brightness of said defective part of an image which said image information expresses calculated with said operation means may change.

[Claim 16] It is based on characteristic quantity of the 1st step and a defective part which detect a defective part of an image which image information expresses. [whether a correction method which should be applied to correction of a defective part is chosen from two or more sorts of correction methods, and] Or the 2nd step which determines each applicability of two or more correction methods applied to correction of a defective part, And to said image information [whether a defective part is corrected with the application of said selected correction method, and] Or a record medium with which a program for making a computer perform processing containing the 3rd step which is in said determined applicability, applies said two or more correction methods respectively, and corrects a defective part was recorded.

[Claim 17] While calculating image characteristic quantity respectively to a defective part which exists in an image which image information expresses along two or more mutually different directions out of this defective part The 1st step which performs respectively calculating with interpolation an adjusted value for correcting said defective part from information on a field which exists in the predetermined direction on an image to said defective part about said two or more directions, The 2nd step which calculates the last adjusted value from an adjusted value for said every direction based on image characteristic quantity for said every direction, And a record medium with which a program for making a computer perform processing containing the 3rd step which corrects said defective part using said last adjusted value to said image information was recorded.

[Claim 18] A record medium with which a program for making a computer perform processing characterized by providing the following was recorded Transparency or the amount of reflected lights of the non-light in near [said] the defective part when irradiating the non-light at said image recording material to a defective part of said image detected from image information showing an image recorded on an image recording material The 2nd step at which brightness of said defective part of the 1st step which calculates the amount of brightness modification for correcting said defective part based on a difference of a refractive index of the light in an image

recording material and the non-light, and an image which said image information expresses corrects image information so that only brightness variation calculated with said operation means may change

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[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to an image processing system, a method, and a record medium, and relates to the record medium with which the program for operating the image-processing method applicable to the image processing system which corrects the defective part in the image which image information expresses especially, and this image processing system, and a computer as an image processing system was recorded.
[0002]
[Description of the Prior Art] Although a photographic film may be dealt with and a blemish may be attached to an emulsion side or a back side (rear face of an emulsion side) depending on the direction Although it will be based also on the degree of a blemish supposing it outputs the image currently recorded on this photographic film (it displays on image recording materials, such as printing paper, at display means, such as record or a display), when it has the blemish in the part which corresponds in the image recording field of a photographic film The blemish attached to the photographic film is clearly checked by looking on an output image as defective parts, such as a low-concentration muscle and a white muscle, in many cases. Moreover, also when foreign matters, such as dust, have adhered on the surface of a photographic film, this foreign matter is clearly checked by looking as a defective part.
[0003] In the photograph printing equipment of the field exposure type which carries out exposure record of the image at printing paper by irradiating the light which irradiated light at the photographic film and penetrated the photographic film at printing paper, a photographic film gets damaged, as a cure, a diffusion board is arranged between the light source and a photographic film, and the light scattered about with the diffusion board is irradiated at the photographic film. however, with the above-mentioned technology, it is difficult to eliminate the defective part in an output image (image which carried out exposure record at printing paper), and a defect is mitigated a little (it stops being conspicuous) — it is .
[0004] As technology which can apply the image recorded on the photographic film to the image reader of a configuration of reading by reading sensors, such as CCD, moreover, to JP,11-75039,A A photographic film is read respectively in three waves of light regions, and at least four or more waves of wavelength regions including one wave of non-light region (for example, an infrared region and an ultraviolet region). Based on the information acquired by reading by the non-light region, the technology which amends the image information obtained by reading by the light region is indicated.
[0005] While the amount of transmitted lights changes according to the image concentration by which the light of a light region is recorded on the photographic film, a part of light is refracted with a blemish or a foreign matter also in the part where the blemish and the foreign matter are attached to the photographic film, or the amount of transmitted lights changes by being reflected. On the other hand, the effect of the image concentration by which the light of a non-light region is recorded on the photographic film although the amount of transmitted lights changes in the part where the blemish and the foreign matter are attached to the photographic film does not win popularity.

[0006] Therefore, the thing for which fluctuation of the amount of transmitted lights of the light of the light region resulting from the blemish which detects the blemish and foreign matter which are attached to the photographic film from change of the amount of transmitted lights of the light of a non-light region, and is attached to the photographic film, or a foreign matter is amended according to technology given in said official report, That is, it becomes possible to correct the defective part of the image (image which the image information obtained by reading by the light region expresses) resulting from the blemish which it has in the photographic film, or a foreign matter.
[0007]
[Problem(s) to be Solved by the Invention] By the way, the various correction methods can be considered as the correction method (correction algorithm) for correcting a defective part. For example, the correction method which determines the brightness and concentration of a defective part with interpolation from the information on the field around a defective part, and corrects a defective part (the interpolation method), The correction method (the brilliance-control method) which corrects the defective part of an image by adjusting the brightness of a defective-part field, the correction method (how to obscure) which corrects a defective part by reducing the high frequency component of the spatial frequency in the field of a defective part or its neighborhood, and obscuring a defective part can be considered.
[0008] however, the above — any correction method has a certain defect. Namely, since the interpolation method performs interpolation from the concentration change in said perimeter field on the assumption that it is changing smoothly [the concentration of the original image], and continuously in the perimeter field which adjoins the inside of a defective part, and this defective part For example, an un-proper correction result which the precision (reproducibility of the concentration of the image of a dimension) of a interpolation operation is low in originally concentration changing intricately into a defective part etc., and gives sense of incongruity to it may be brought.
[0009] Moreover, there is also a defect that correction precision varies greatly by the defective part for correction since the proper interpolation direction which can correct a defective part proper although correction precision is greatly different whether it interpolates using the information on the field which exists in which direction (the interpolation direction) among the fields around a defective part in correction of the defective part by the interpolation method changes with defective parts.
[0010] Moreover, the color of said defective part on the image data obtained when it has the blemish, for example in the emulsion side side of a photographic film or the defective part which originates in the foreign matter having adhered to the photographic film, and is produced reads the image recorded on the photographic film is different from the color of the portion which is equivalent to a photographic film at said defective part in the photographic subject by which photography record was carried out in many cases. On the other hand, since the brilliance-control method adjusts only brightness, without changing the color of a defective part, it is difficult to correct the above defective parts with a sufficient precision.
[0011] Moreover, although the amount of brilliance controls is determined by the brilliance-control method based on change of the amount of transmitted lights of the light of the non-light region in near a defective part For the reason nil why the refractive index by the blemish which it has in the photographic film is different with the wavelength of light etc. Change of the amount of transmitted lights of the light of the non-light region in near a defective part may be different from change of the amount of transmitted lights of the light of the light region resulting from the blemish in near a defective part etc. a little. Even if it corrected the defective part according to the amount of brilliance controls determined based on change of the amount of transmitted lights of the light of a non-light region, the difference of change of said amount of transmitted lights might remain as a minute defective part, for example.
[0012] Moreover, since the method of obscuring reduces the high frequency component of the spatial frequency in the field of a defective part or its neighborhood and a defective part is obscured, it is not suitable for correction of the defective part resulting from adhesion of a deep blemish or a foreign matter with comparatively big size. That is, in order to correct the above

defective parts, it is necessary to enlarge the degree which obscures a defective part, and the image quality fall of an image may be caused. Thus, even if it applied any of the various correction methods mentioned above, it was difficult to correct each of various defective parts equipped with the mutually different feature with a sufficient precision.

[0013] On the other hand, also when the cel (the so-called defective pixel) in which the relation between the amount of incident light and an output signal differs from expected relation exists in many photo-electric-conversion cels of optoelectric transducers, such as CCD which the digital still camera (it is only called a digital camera below DSC:) builds in, the defective part resulting from the blemish attached to the photographic film or a foreign matter and the same defective part arise in the image which the image data obtained by picturizing a photographic subject expresses. Although it was correctable like [this defective part] the defective part resulting from the blemish attached to the photographic film, or a foreign matter, even if it applied said which correction method to this correction, it was difficult to correct each of various defective parts with a sufficient precision.

[0014] It is the 1st purpose to obtain the image processing system which this invention was accomplished in consideration of the above-mentioned fact, and can correct various defective parts with a sufficient precision respectively, a method, and a record medium.

[0015] Moreover, it is the 2nd purpose that this invention obtains the image processing system, method, and record medium which can control dispersion in the correction precision in correction of the defective part by the interpolation method.

[0016] Furthermore, it is the 3rd purpose that this invention obtains the image processing system, method, and record medium which can raise the correction precision of the defective part by the brilliance-control method.

[0017]

[Means for Solving the Problem] Although two or more sorts of correction methods for correcting a defective part of an image have a certain defect as mentioned above While a correctable defective part changes for every correction method proper with these correction methods, an invention-in-this-application person A point of having the feature from which a defective part from which a proper correction method differs differs mutually is noted. Based on the image characteristic quantity, for each defective part of every in an image [whether any one is alternatively applied out of two or more sorts of correction methods, and] Or it hits on an idea for various kinds of defective parts to be correctable with a sufficient precision by defining each applicability proper, combining two or more correction methods, and applying them out of two or more sorts of correction methods, and came to accomplish invention of claim 1.

[0018] Based on the above, an image processing system applied to invention according to claim 1 in order to attain the 1st purpose It is based on a detection means to detect a defective part of an image which image information expresses, and characteristic quantity of a defective part. A decision means to determine each applicability of two or more correction methods which choose a correction method which should be applied to correction of a defective part from two or more sorts of correction methods, or are applied to correction of a defective part, It is constituted including a correction means which corrects a defective part to said image information with the application of a correction method chosen by said decision means, or is in applicability determined by said decision means, applies said two or more correction methods respectively, and corrects a defective part.

[0019] An image processing system concerning invention according to claim 1 specifically For example, light which irradiated light, and penetrated or reflected said image recording material in image recording materials, such as photosensitive material Image information of an image recorded on said image recording material by what is done for photo electric conversion by optoelectric transducer equipped with many photo-electric-conversion cels (it reads) is acquired. May be the configuration output by performing various kinds of amendments (for example, dark amendment, a shading compensation, etc.) and various kinds of image processings (for example, color correction, concentration amendment, etc.), and Image information of an image which includes said photographic subject by carrying out photo electric conversion of the light from a photographic subject by optoelectric transducer may be acquired, and you may be

the configuration (the so-called digital camera) of storing acquired image information in information storage data medium. Moreover, equipment of a configuration of acquiring image information from image information input devices, such as an image reader which reads an image recorded on an image recording material or this image reader, and a digital camera, may be used as an image processing system concerning invention of claim 1.

[0020] Moreover, an image processing system concerning invention of claim 1 is equipped with a detection means to detect a defective part of an image which image information expresses. Detection of this defective part can specifically be performed as follows. That is, as indicated also to claim 2, detecting a defective part resulting from a blemish which it has into an image recording material, or a foreign matter, when image information expresses an image recorded on an image recording material irradiates the non-light at an image recording material with which an image was recorded, and it is detectable from a result of having carried out photo electric conversion of the non-light which penetrated or reflected an image recording material. Moreover, if information for specifying a defective pixel of an optoelectric transducer discovered by inspection at the time of manufacture of an image processing system is memorized by storage means, it can perform detecting a defective part resulting from a defective pixel of an optoelectric transducer in a mode which acquires image information using an optoelectric transducer by reading information for specifying a defective pixel memorized by this storage means.

[0021] Moreover, since a decision means concerning invention of claim 1 determines each applicability of two or more correction methods which choose a correction method which should be applied to correction of a defective part from two or more sorts of correction methods based on characteristic quantity of a defective part, or are applied to correction of a defective part, it can choose optimal correction method or can determine optimal applicability so that a defective part may be corrected proper. In addition, as two or more sorts of correction methods, as indicated, for example to claim 5, a interpolation method of searching for information on a defective part with interpolation from information on a field around this defective part, and a brilliance-control method which corrects image information so that brightness of a defective part may change can be included. Moreover, a method of obscuring which corrects image information so that a high frequency component of spatial frequency in a field of a defective part or its neighborhood may be reduced and a defective part may fade may be included.

[0022] And since the correction means concerning invention of claim 1 corrects a defective part to image information with the application of the correction method chosen by decision means, or it is in applicability determined by decision means, applies the two or more correction methods respectively and corrects a defective part, it becomes that it is possible to correct respectively various defective parts (for example, the defective part from which a correction method which can correct differs proper) with a sufficient precision.

[0023] In addition, when image information expresses an image recorded on an image recording material, as indicated to claim 2, it is desirable [a detection means] to detect a defective part of an image from a result of having carried out photo electric conversion of the non-light which irradiated the non-light, and penetrated or reflected an image recording material in an image recording material with which an image was recorded. A defective part which originates in a blemish or a foreign matter attached in an image recording field of an image recording material by this is certainly detectable.

[0024] Invention according to claim 3 is set to invention of claim 1. A decision means Correlation of concentration change for every component color in near the defective part of an image which image information expresses as characteristic quantity of a defective part, It is characterized by making selection of a correction method which should be applied, or a decision of applicability using at least one of the duplication rates with said principal part field of whether distribution of concentration in a field around a defective part of said image and a defective part exist in a principal part field in said image, and a defective part.

[0025] For example, although a defective part in which information on the original color remains is correctable with a sufficient precision by brilliance-control method or other similar correction methods, a interpolation method and other similar correction methods are suitable for correction

of a defective part in which the original color does not remain. If information on the original color remains in a defective part, correlation of concentration change for every component color in near a defective part is strong, and since said correlation has many weak things if information on the original color does not remain in a defective part, based on correlation of concentration change for every component color in near a defective part, a defective part from which a correction method proper as mentioned above differs can be carved.

[0026] Moreover, although a defective part with a loose change of concentration in a surrounding field is correctable with a sufficient precision by interpolation method or other similar correction methods, for example Correction of a defective part when a part (the so-called edge) and a texture (condition that a fine encaustic pattern is distributed uniformly) from which concentration is changing rapidly exist in a field around a defective part Although it is dependent on whether the original color remains in a defective part, a brilliance-control method and other similar correction methods are suitable. The above defective parts from which a proper correction method differs can be carved based on distribution of concentration in a field around a defective part.

[0027] Furthermore, a principal part field in an image (for example, field equivalent to a person's face) Since it is the field which attracts attention in appreciation of an image etc., when a defective part is located in a principal part field, or when a duplication rate is [that a part of defective part overlaps a principal part field] high Although it is dependent on whether the original color remains in a defective part preferably that a correction result of this defective part serves as unsuitable positive, a brilliance-control method and other similar correction methods are suitable. a ****** [that, as for the above defective parts, a defective part exists in a principal part field in an image] -- or it can extract based on a duplication rate with a principal part field of a defective part.

[0028] In invention of claim 3, since selection of a correction method which should be applied, or a decision of applicability be made using at least one of the duplication rates with a principal part field of whether distribution of concentration in a field correlation of concentration change for every component color in near a defective part and around a defective part and a defective part exist in a principal part field, and a defective part, selection of a correction method or a decision of applicability can be made with a sufficient precision.

[0029] Invention according to claim 4 is set to invention of claim 2. A decision means Transparency of the non-light in near the defective part when irradiating the non-light as characteristic quantity of a defective part at an image recording material, or change of the amount of reflected lights, It is characterized by making selection of a correction method which should be applied to an image recording material using either [at least] transparency of the light in near the defective part when irradiating the light or correlation of change of the amount of reflected lights and transparency of the non-light in near a defective part or the amount of reflected lights, or a decision of applicability.

[0030] Although it can judge as mentioned above from correlation of concentration change for every component color in near a defective part, whether information on the original color remains in a defective part If information on the original color remains in a defective part when image information expresses an image currently recorded on an image recording material Transparency of the non-light in near the defective part when irradiating the non-light at an image recording material, or change of the amount of reflected lights, Transparency of the light in near the defective part when irradiating the light at an image recording material or correlation of change of the amount of reflected lights becomes strong, and said correlation becomes weak if information on the original color does not remain in a defective part. Therefore, based on transparency of the non-light in near a defective part, and the light, or correlation of change of the amount of reflected lights, it can discriminate from a defective part from which a proper correction method differs.

[0031] Moreover, since a defective part with a big scale etc. is conspicuous when a correction result serves as unsuitable positive, a brilliance-control method and other similar correction methods are suitable for correction of such a defective part. When image information expresses an image recorded on an image recording material, a scale of a defective part in an image which

this image information expresses etc. can be judged from transparency or the amount of reflected lights of the non-light in near the defective part when irradiating the non-light at an image recording material.
[0032] In invention of invention of claim 4, since selection of a correction method which should be applied, or a decision of applicability is made using either [at least] transparency of the non-light in near a defective part, and the light or correlation of change of the amount of reflected lights and transparency of the non-light in near a defective part or the amount of reflected lights, selection of a correction method or a decision of applicability can be made with a sufficient precision.
[0033] by the way -- for example, an image recording material is the transparency manuscript (for example, photographic film) with which two or more sorts of mutually different pigment layers were respectively formed in one [which has light transmission nature] field of a base material -- etc. -- a case -- an image recording material -- a blemish -- being attached -- **** -- a part, although the amount of transmitted lights generally falls irrespective of wavelength of light When a pigment layer of an image recording material has received damage by blemish, the amount of transmitted lights of light of a wavelength region corresponding to a carrier beam pigment layer increases damage rather than the amount [in / for damage / a part around a carrier beam part] of transmitted lights. And since information on the original color does not remain in a defective part produced by blemish when a pigment layer has received damage by blemish as mentioned above, a interpolation method and other similar correction methods are suitable for correction of such a defective part.
[0034] When the non-light and light of two or more predetermined wavelength regions in a visible region are respectively irradiated by invention according to claim 6 at an image recording material based on the above About the non-light, the amount of transmitted lights in a defective part is lower than the amount of transmitted lights in a field around a defective part. About light of at least one wavelength region in said two or more wavelength regions When the amount of transmitted lights in a defective part is higher than the amount of transmitted lights in a field of said perimeter, a interpolation method of searching for information on a defective part with interpolation from information on a field around this defective part is chosen as the correction method which should be applied to correction of a defective part. Thereby, it can judge correctly whether it is a defective part corresponding to a part where a pigment layer has received damage by blemish to which a defective part for the correction method selection was attached to an image recording material, and a defective part resulting from a blemish which has done damage to a pigment layer can be corrected with a sufficient precision.
[0035] Moreover, although it is possible that it has a blemish which does not do damage in a pigment layer in said predetermined part, or a foreign matter has adhered when a fall of the amount of transmitted lights arises irrespective of wavelength of light in a predetermined part on an image recording material corresponding to a defective part For example, when a part to which the amount of transmitted lights falls irrespective of wavelength of light exists in an image recording material after removing an adhering foreign matter, It is surmised that it has a blemish which does not do damage in a pigment layer in this part, and since information on the original color remains in a defective part produced by the above blemishes, a brilliance-control method and other similar correction methods are suitable for correction of this defective part.
[0036] When the non-light and light of two or more predetermined wavelength regions in a visible region are respectively irradiated by invention according to claim 7 at an image recording material based on the above When the amount of transmitted lights in a defective part is lower than the amount of transmitted lights in a field around a defective part about both the non-light and light of two or more of said wavelength regions, a brilliance-control method which corrects image information as the correction method which should be applied to correction of a defective part so that brightness of a defective part may change is chosen. Thereby, it can judge correctly whether it is a defective part corresponding to a part where a pigment layer has not received damage by blemish to which a defective part for the correction method selection was attached to an image recording material, and a defective part resulting from a blemish which has not done damage to a pigment layer can be corrected with a sufficient precision.

[0037] An image processing system applied to invention according to claim 8 in order to attain the 2nd purpose A characteristic quantity operation means to calculate image characteristic quantity respectively to a defective part which exists in an image which image information expresses along two or more mutually different directions out of this defective part, An individual adjusted value operation means to perform respectively calculating with interpolation an adjusted value for correcting said defective part from information on a field which exists in the predetermined direction on an image to said defective part about said two or more directions, A last adjusted value operation means to calculate the last adjusted value based on image characteristic quantity for every direction calculated with said characteristic quantity operation means from an adjusted value calculated for every direction with said individual adjusted value operation means, It is constituted to said image information including a correction means which corrects said defective part using the last adjusted value calculated with said last adjusted value operation means.
[0038] In invention according to claim 8, image characteristic quantity calculates respectively with a characteristic quantity operation means to a defective part which exists in an image which image information expresses along two or more mutually different directions out of this defective part. In addition, image characteristic quantity relevant to a boundary location with image characteristic quantity, and a defective part and a non-defective part which can judge whether image characteristic quantity which can evaluate whether it is the interpolation direction where each direction is proper as image characteristic quantity which a characteristic quantity operation means calculates can be used, for example, a boundary and a texture of an image field exist can be used.
[0039] Moreover, it performs respectively that the individual adjusted value operation means concerning invention of claim 8 calculates with interpolation an adjusted value for correcting a defective part from information on a field which exists in the direction predetermined in an image top to a defective part about two or more directions, and a last adjusted value operation means calculates the last adjusted value from the adjusted value which calculated for every direction with an individual adjusted value operation means based on the image characteristic quantity for every direction calculated with a characteristic-quantity operation means. The last adjusted value can determine weight for every direction from image characteristic quantity for every direction, and can ask for it by calculating a weighted average of an adjusted value for every direction etc.
[0040] Thus, in invention of claim 8, a possibility that which direction has agreed in the proper interpolation direction since an adjusted value is respectively calculated about two or more directions is high, and since the last adjusted value is calculated from an adjusted value for every direction based on image characteristic quantity for every direction, the last adjusted value can be calculated so that effect which an adjusted value about a direction presumed to be the proper interpolation direction from image characteristic quantity does may become large to the last adjusted value. Therefore, according to invention of claim 8, effect by the proper interpolation direction being different for each defective part of every can be made small, and dispersion in correction precision in correction of a defective part by interpolation method can be controlled.
[0041] Invention according to claim 9 is set to invention of claim 8. A characteristic quantity operation means Quantity of light change which met in the predetermined direction of the non-light which penetrated or reflected an image recording material when irradiating the non-light in an image recording material with which an image which concentration change of an image which met in the predetermined direction as image characteristic quantity, and image information express was recorded, When an image is followed along the number of defective pixels which exist on an image in fixed distance along a predetermined direction, and a predetermined direction, it is characterized by thing of distance ** until a normal pixel which does not belong to a defective part appears for which it calculates at least any they are respectively about two or more directions.
[0042] Since a interpolation method interpolates on the assumption that it is changing smoothly [concentration of the original image], and continuously in a perimeter field which adjoins the

inside of a defective part, and this defective part For example, when a field where concentration is changing greatly or intricately like a boundary of a different image field or a texture exists in the perimeter of a defective part, Precision of a interpolation operation when making into the interpolation direction a direction where said field exists is low, and the proper interpolation direction (direction where a high interpolation operation precision is acquired) turns into a direction where said field exists, and a different direction. A boundary of the above image fields, existence of a texture, etc. can be judged from concentration change of an image which met in each direction.
[0043] Moreover, by interpolation method, precision of a interpolation operation falls as the length (interpolation length) of a defective part which met in the interpolation direction becomes long, and the proper interpolation direction turns into a direction where interpolation length is short. Quantity of light change of the non-light which penetrated or reflected an image recording material when interpolation length irradiates the non-light at an image recording material with which an image which image information expresses was recorded (thereby, a boundary location of a defective part is detectable), Or when the number of defective pixels which exist on an image in fixed distance, or an image is followed, it can judge from any of distance until a normal pixel which does not belong to a defective part appears, or (image characteristic quantity relevant to a boundary location of a defective part and a non-defective part).
[0044] Concentration change of an image which met in the predetermined direction as image characteristic quantity in invention of claim 9, Quantity of light change which met in the predetermined direction of the non-light which penetrated or reflected an image recording material, The number of defective pixels which exist on an image in fixed distance along a predetermined direction, And since or [any] is respectively calculated at least about two or more directions of distance ** until a normal pixel which does not belong to a defective part appears when an image is followed along a predetermined direction, image characteristic quantity as which each of two or more directions can estimate correctly whether it is the proper interpolation direction is obtained.
[0045] Invention according to claim 10 is characterized by performing respectively that either [at least] a characteristic quantity operation means or an individual adjusted value operation means calculates image characteristic quantity or an adjusted value in the range until a fixed number of normal pixels which do not belong to a defective part appear when an image is followed along the predetermined direction about two or more directions in invention of claim 8.
[0046] In invention of claim 10, since it is carried out in the range until a normal pixel by which it does not belong to a defective part when image characteristic quantity for every direction or an operation of an adjusted value follows an image along the predetermined direction carries out a fixed number of (for example, number of degrees which do not cause trouble to operation of image characteristic quantity or adjusted value) appearances, time amount which an operation of image characteristic quantity or an adjusted value takes can be shortened.
[0047] An image processing system applied to invention according to claim 11 in order to attain the 3rd purpose Transparency or the amount of reflected lights of the non-light in near [said] the defective part when irradiating the non-light at said image recording material to a defective part of said image detected from image information showing an image recorded on an image recording material, An operation means to calculate the amount of brightness modification for correcting said defective part based on a difference of a refractive index of the light in an image recording material and the non-light, Brightness of said defective part of an image which said image information expresses is constituted including a correction means to correct image information so that only brightness variation calculated with said operation means may change.
[0048] Although it changes according to chisels, such as a blemish which effect of image concentration by which transparency or the amount of reflected lights of the non-light when irradiating the non-light at an image recording material is recorded on an image recording material does not win popularity, but it has into an image recording material Transparency of the light resulting from a blemish which it has into an image recording material when irradiating the light, or variation of the amount of reflected lights is different from an image recording material with a difference of a refractive index of the light [in / in transparency of the non-light at this

time or variation of the amount of reflected lights / an image recording material] and the non-light.
[0049] On the other hand, an operation means concerning invention according to claim 11 Since the amount of brightness modification for correcting a defective part to an image recording material based on a difference of a refractive index of transparency or the amount of reflected lights of the non-light in near the defective part when irradiating the non-light, and the light in an image recording material and the non-light is calculated Transparency of the light resulting from a blemish which it has into an image recording material, or variation of the amount of reflected lights can be calculated correctly, and the amount of brightness modification can be calculated so that this variation may be amended correctly. And since only calculated brightness variation corrects image information so that brightness of a defective part may change, a correction means can raise correction precision of a defective part by brilliance-control method.
[0050] in addition, about a difference of a refractive index of the light in an image recording material and the non-light A value which extracted a high frequency component from transparency of the non-light in near the defective part when irradiating the non-light at an image recording material, or change of the amount of reflected lights as indicated to claim 12, Characteristic quantity showing said difference can be obtained by calculating a ratio of a value and ** which extracted a high frequency component from transparency of the light in near the defective part when irradiating the light at an image recording material, or change of the amount of reflected lights. By extracting a high frequency component from change of the quantity of light of the non-light and the light, a dc component and a low-frequency component (it is almost the case that these are not the components resulting from a blemish etc.) of quantity of light change can be removed, and characteristic quantity which expresses correctly a ratio of the quantity of light resulting from a difference of said refractive index can be obtained.
[0051] Moreover, about a difference of said refractive index, as indicated to claim 12, it is also possible to acquire characteristic quantity showing said difference based on a class of image recording material. That is, since a difference of a refractive index for every wavelength of light becomes settled about according to the quality of the material (in detail quality of the material of a base material) of an image recording material, it can specify a difference of a refractive index of the light and the non-light from a class of image recording material, and can acquire characteristic quantity showing said difference.
[0052] As characteristic quantity which expresses a difference of a refractive index of the light in an image recording material and the non-light with invention of claim 12 A value which extracted a high frequency component from transparency of the non-light in near a defective part, or change of the amount of reflected lights, Since a ratio of a value and ** which extracted a high frequency component from transparency of the light in near a defective part or change of the amount of reflected lights is calculated or said characteristic quantity is acquired based on a class of image recording material The amount of brightness modification which can amend correctly transparency of the light resulting from a blemish which it has into an image recording material, or change of the amount of reflected lights by calculating the amount of brightness corrections using this characteristic quantity can be obtained.
[0053] An image-processing method concerning invention according to claim 13 Detect a defective part of an image which image information expresses, and it is based on characteristic quantity of a defective part. [whether a correction method which should be applied to correction of a defective part is chosen from two or more sorts of correction methods, and] Or each applicability of two or more correction methods applied to correction of a defective part is determined. Since a defective part is corrected with the application of said selected correction method, or it is in said determined applicability, said two or more correction methods are applied respectively and a defective part is corrected to said image information, it becomes possible like invention of claim 1 to correct various defective parts with a sufficient precision respectively.
[0054] An image-processing method concerning invention according to claim 14 While calculating image characteristic quantity respectively to a defective part which exists in an image which image information expresses along two or more mutually different directions out of this defective part It performs respectively calculating with interpolation an adjusted value for correcting said

defective part from information on a field which exists in the predetermined direction on an image to said defective part about said two or more directions. Since the last adjusted value is calculated from an adjusted value for said every direction and said defective part is corrected to said image information using said last adjusted value based on image characteristic quantity for said every direction Dispersion in correction precision in correction of a defective part by interpolation method can be controlled like invention of claim 8.

[0055] An image-processing method concerning invention according to claim 15 Transparency or the amount of reflected lights of the non-light in near [said] the defective part when irradiating the non-light at said image recording material to a defective part of said image detected from image information showing an image recorded on an image recording material, It is based on a difference of a refractive index of the light in an image recording material and the non-light. Since image information is corrected so that only brightness variation which calculated the amount of brightness modification for correcting said defective part, and brightness of said defective part of an image which said image information expresses calculated with said operation means may change A defective part is correctable to high degree of accuracy by brilliance-control method like invention of claim 11.

[0056] The 1st step which detects a defective part of an image with which image information expresses a record medium concerning invention according to claim 16, [whether based on characteristic quantity of a defective part, a correction method which should be applied to correction of a defective part is chosen from two or more sorts of correction methods, and] Or the 2nd step which determines each applicability of two or more correction methods applied to correction of a defective part, And to said image information [whether a defective part is corrected with the application of said selected correction method, and] Or a program for making a computer perform processing containing the 3rd step which is in said determined applicability, applies said two or more correction methods respectively, and corrects a defective part is recorded.

[0057] Since a program for operating processing containing the above 1st thru/or the 3rd step, i.e., a computer, as a record medium concerning invention according to claim 16 as an image processing system according to claim 1 is recorded, a computer becomes possible [correcting various defective parts with a sufficient precision respectively] like invention of claim 1 by reading and executing a program recorded on said record medium.

[0058] While a record medium concerning invention according to claim 17 calculates image characteristic quantity respectively to a defective part which exists in an image which image information expresses along two or more mutually different directions out of this defective part The 1st step which performs respectively calculating with interpolation an adjusted value for correcting said defective part from information on a field which exists in the predetermined direction on an image to said defective part about said two or more directions, The 2nd step which calculates the last adjusted value from an adjusted value for said every direction based on image characteristic quantity for said every direction, And a program for making a computer perform processing containing the 3rd step which corrects said defective part using said last adjusted value to said image information is recorded.

[0059] Since a program for operating processing containing the above 1st thru/or the 3rd step, i.e., a computer, as a record medium concerning invention according to claim 17 as an image processing system according to claim 8 is recorded By reading and executing a program to which a computer was recorded on said record medium, dispersion in correction precision in correction of a defective part by interpolation method can be controlled like invention of claim 8.

[0060] As opposed to a defective part of said image detected from image information to which a record medium concerning invention according to claim 18 expresses an image recorded on an image recording material Transparency or the amount of reflected lights of the non-light in near [said] the defective part when irradiating the non-light at said image recording material, It is based on a difference of a refractive index of the light in an image recording material and the non-light. The 1st step which calculates the amount of brightness modification for correcting said defective part, A program for making a computer perform processing whose brightness of said defective part of an image which said image information expresses contains the 2nd step

which corrects image information so that only brightness variation calculated with said operation means may change is recorded.
[0061] Since a program for operating processing containing the above 1st and the 2nd step, i.e., a computer, as a record medium concerning invention according to claim 18 as an image processing system according to claim 11 is recorded, a computer can correct a defective part to high degree of accuracy by brilliance-control method like invention of claim 11 by reading and executing a program recorded on said record medium.
[0062]
[Embodiment of the Invention] Hereafter, an example of the operation gestalt of this invention is explained to details with reference to a drawing. In addition, below, the case where the defective part which originates in the blemish which it has in the photographic film, or a foreign matter as an example is corrected is explained.
[0063] The image processing system 10 concerning this operation gestalt is shown in drawing 1 . A film scanner 12, an image processing system 14, and a printer 16 are connected to a serial, and the image processing system 10 is constituted. In addition, the film scanner 12 and the image processing system 14 are equivalent to the image processing system concerning this invention.
[0064] A film scanner 12 reads the image (the negative image or positive image visualized by a development being carried out after photoing a photographic subject) currently recorded on photosensitive material (a photographic film is only called below), such as a photographic film (for example, a negative film and a reversal film), outputs the image data obtained by this reading, and as shown also in drawing 2 , it is equipped with the light source 20 which consists of a halogen lamp etc. and irradiates light at a photographic film 26. In addition, the light injected from the light source contains respectively the light of the wavelength of a light region, and the light of the wavelength of an infrared region.
[0065] The optical diffusion box 22 which makes the diffused light light which irradiates the drawing 21 for adjusting the quantity of light of the light which irradiates a photographic film 26, a filter unit 23, and a photographic film 26 is arranged in order at the irradiation appearance side of the light source 20. Filter 23C which makes only the light (R light) of the wavelength region where a filter unit 23 is equivalent to R among incident light penetrate, Filter 23M which make only the light (G light) of the wavelength region which is equivalent to G among incident light penetrate, Four filters of filter 23Y which makes only the light (B light) of the wavelength region which is equivalent to B among incident light penetrate, and filter 23IR which makes only the light (IR light) of an infrared region penetrate among incident light are inserted in turret 23A made pivotable along the direction of drawing 2 arrow head A, and are constituted.
[0066] On both sides of the photographic film 26, the lens 28 to which image formation of the light which penetrated the photographic film 26 is carried out, and area CCD 30 are arranged in order in accordance with the optical axis L in the light source 20 and the opposite side. The CCD cel of a large number which have sensitivity in a light region and an infrared region respectively is CCD of the monochrome arranged in the shape of a matrix, and area CCD 30 is arranged so that a light-receiving side may be in agreement with the image formation point location of a lens 28. Moreover, the shutter (illustration abbreviation) is formed between area CCD 30 and a lens 28.
[0067] Area CCD 30 is connected to the scanner control section 33 through the CCD driver 31. The scanner control section 33 is equipped with CPU, ROM (for example, ROM which can rewrite the contents of storage), RAM, and input/output port, and these are mutually connected through a bus etc. and it is constituted. The scanner control section 33 controls actuation of each part of a film scanner 12. Moreover, the CCD driver 31 generates the driving signal for driving area CCD 30, and controls the drive of area CCD 30.
[0068] A photographic film 26 is conveyed by the tape carrier package 24 (drawing 2 refer to drawing 1 , illustration abbreviation), and the photograph center of an image is positioned in the location (reading station) which is in agreement with an optical axis L. Moreover, the scanner control section 33 is in the condition that the image is positioned by the reading station. While carrying out the rotation drive of the turret 23A of a filter unit 23 so that all the filters 23

containing filter 23IR may be located on an optical axis L in order The charge storage time of the area CCD 30 corresponding to predetermined reading conditions (the reading conditions defined fixed beforehand or reading conditions which were determined by performing a press can) is set to the CCD driver 31, and drawing 21 is moved to the location corresponding to said predetermined reading conditions.
[0069] Thereby, the light of the wavelength region (R, G, B, or IR) corresponding to each filter 23 is irradiated in order by the image recording field on a photographic film 26, photo electric conversion of the light which penetrated the image recording field on a photographic film 26 is carried out by area CCD 30, and it is outputted as a signal from area CCD 30. The signal outputted from area CCD 30 is changed into the digital data showing the amount of transmitted lights by A/D converter 32, and is inputted into an image processing system 14.
[0070] In addition, the amount of transmitted lights of the light of each wavelength region of R, G, and B changes according to R of the image currently recorded on the image recording field, G, and B concentration (although it changes also with these when the blemish and the foreign matter are attached to the photographic film 26, the amount of transmitted lights of IR light is not influenced of image concentration, but changes with chisels, such as a blemish and a foreign matter). Therefore, it is equivalent to reading an image to carry out photo electric conversion of the transmitted light of each wavelength region of R, G, and B, and each data (image data) of R, G, and B except IR supports the image information of this invention among the data of each wavelength region of R, G, B, and IR inputted into an image processing system 14.
[0071] On the other hand, the scanner amendment section 36 of an image processing system 14 performs various kinds of amendment processings, such as dark amendment, concentration conversion, and a shading compensation, in order to the inputted image data (and IR data). The outgoing end of the scanner amendment section 36 is connected to the input edge of I/O controller 38, and the image data to which said each processing was performed in the scanner amendment section 36 is inputted into I/O controller 38. The input edge of I/O controller 38 is connected also to the data output edge of an image processor 40, and the image data to which the image processing (it mentions later for details) was performed from the image processor 40 is inputted.
[0072] Moreover, the input edge of I/O controller 38 is connected also to the control section 42. The control section 42 is equipped with the expansion slot (illustration abbreviation), and the communication controller for communicating with the driver (illustration abbreviation) which performs read-out/writing of data (or program) to information storage data medium, such as a PC card with which a digital still camera can be loaded, an IC card (these are hereafter named a digital camera card generically), CD-ROM, and MO, CD-R, and other information management systems is connected to this expansion slot. The image data inputted from the outside through the expansion slot is inputted into I/O controller 38.
[0073] It connects with the data input edge and control section 42 of an image processor 40 respectively, and the outgoing end of I/O controller 38 is further connected to the printer 16 through the I/F circuit 54. I/O controller 38 outputs the inputted image data to said each device connected to the outgoing end alternatively.
[0074] This operation gestalt performs two reading in different resolution in a film scanner 12 to each image currently recorded on the photographic film 26. In addition, it sets like this operation gestalt in the mode using the area sensor (area CCD 30) as a reading sensor. The change (obtain the image data of resolution which is different by reading of each time) of the resolution of reading For example, it reads with the high resolution same also at the time of a press can as the time of a fine scan. While performing after treatment, such as integration of infanticide of a pixel, or a pixel, to the obtained image data or reading two or more times by the area sensor at the time of a fine scan Only the distance which is equivalent to 1 for an integer of a pixel gap with actuators, such as a piezo-electric element, at the time of reading of each time is realizable by moving an area sensor.
[0075] Reading of each image is performed on the reading conditions (quantity of light for every wavelength region of R, G, and B of the light which irradiates a photographic film 26, charge storage time of area CCD 30) comparatively determined that the saturation of stored charge will

not arise in area CCD 30 by reading (press can) by the low resolution also when [1st] the concentration of an image was very low. In addition, with this operation gestalt, IR reading is not performed at the time of a press can. The data (press can image data) obtained by this press can is inputted into a control section 42 from I/O controller 38.

[0076] A control section 42 is equipped with CPU46, RAM48, ROM50 (for example, ROM which can rewrite the contents of storage), and input/output port 52, and these are mutually connected through a bus and it is constituted. A control section 42 calculates image characteristic quantity, such as concentration of an image, based on the press can image data inputted from I/O controller 38, to each image, determines the reading conditions at the time of a film scanner 12 performing reading (fine scan) for the second time by high resolution comparatively, and outputs the determined reading conditions to a film scanner 12.

[0077] Moreover, a control section 42 calculates image characteristic quantity including the extract of the main image field in an image (for example, field equivalent to a person's face (face field)) based on press can image data, determines automatically the processing conditions of various kinds of image processings over the image data (fine scan image data) obtained when a film scanner 12 performs a fine scan by the operation (setup operation), and outputs the determined processing conditions to an image processor 40.

[0078] In addition, the control section 42 has the function to set up a parameter for the function and image processor 40 which search for whether the defective part resulting from foreign matters attached to the photographic film 26, such as a blemish and dust, has arisen to perform defective-part correction processing into the image which image data expresses, based on IR data inputted from the film scanner 12. Moreover, the display 43, the keyboard 44, and the mouse (illustration abbreviation) are connected to the bus of a control section 42.

[0079] A control section 42 performs an image processing equivalent to the image processing performed by the image processor 40 for fine scan image data to press can image data based on the processing conditions of the calculated image processing, and generates simulation image data. And the generated simulation image data is changed into the signal for displaying an image on a display 43, and a simulation image is displayed on a display 43 based on this signal. Moreover, if the information which assay of image quality etc. is performed by the operator and directs correction of processing conditions as an assay result to the displayed simulation image is inputted through a keyboard 44 or a mouse, based on the inputted information, the re-operation of the processing conditions of an image processing etc. will be performed.

[0080] The image data (fine scan image data) inputted into I/O controller 38 by performing a fine scan to an image by the film scanner 12 on the other hand is inputted into an image processor 40 from I/O controller 38.

[0081] An image processor 40 is respectively equipped with the image-processing circuit which performs various kinds of image processings, such as hyper-sharpness processing in_which sharpness is emphasized, controlling the shape of a color and concentration amendment processing including gray scale conversion or color conversion, pixel density transform processing, the hyper-tone processing that compresses the gradation of the extremely-low-frequency brightness component of an image, and a grain, and performs various image processings to the inputted image data according to the processing conditions determined and notified by the control section 42 for every image. Moreover, the image processor 40 has the function to perform defective-part correction processing according to the parameter set up by the control section 42.

[0082] When using for record of the image to printing paper the image data to which the image processing was performed by the image processor 40, the image data to which the image processing was performed is outputted to a printer 16 as image data for record through the I/F circuit 54 from I/O controller 38 by the image processor 40. Moreover, when outputting to the exterior by making the image data after an image processing into an image file, image data is outputted to a control section 42 from I/O controller 38. This outputs the image data inputted from I/O controller 38 as an object for the output to the exterior to the exteriors (said driver, communication controller, etc.) as an image file through an expansion slot in a control section 42.

[0083] The printer 16 is equipped with the laser driver 62 which controls actuation of an image memory 58, the laser light source 60 of R, G, and B, and this laser light source 60. Once the image data for record inputted from the image processing system 14 is memorized in an image memory 58, reading appearance of it is carried out, and it is used for the modulation of the laser beam of R, G, and B which are injected from a laser light source 60. The laser beam injected from the laser light source 60 has a printing paper 68 top scanned through the polygon mirror 64 and the ftheta lens 66, and exposure record of the image is carried out at printing paper 68. The printing paper 68 in which exposure record of the image was carried out is sent to the processor section 18, and each processing of the color development, bleaching fixing, rinsing, and desiccation is performed. Thereby, the image by which exposure record was carried out is visualized by printing paper 68.
[0084] Next, as an operation of this operation gestalt, if fine scan image data is inputted into an image processing system 14 from a scanner 12, the defective-part adjusted value decision processing performed by the control section 42 will be explained.
[0085] This defective-part adjusted value decision processing is the processing to which the image-processing method according to claim 13 to 15 was applied, and is realized by performing a defective-part adjusted value decision program by CPU46 of a control section 42. The defective-part adjusted value decision program is memorized by the information storage 72 (refer to drawing 1) with the program for performing other processings by CPU46 at the beginning. In addition, although drawing 1 shows the information storage 72 as a floppy disk, you may constitute from a CD-ROM, a memory card, etc.
[0086] If the information read-out equipment (illustration abbreviation) connected to the control section 42 is loaded with information storage data medium 72 and import (install) of the program from information storage data medium 72 to an image processing system 14 is directed, with information read-out equipment, reading appearance of the defective-part adjusted value decision program etc. will be carried out from information storage data medium 72, and ROM50 which can rewrite the contents of storage will memorize. And if the timing which should perform defective-part adjusted value decision processing comes, reading appearance of the defective-part adjusted value decision program will be carried out from ROM50, and this program will be performed by CPU46.
[0087] Thereby, an image processing system 14 functions as claim 1, claim 8, and an image processing system according to claim 11. Thus, information storage data medium 72 which has memorized the defective-part adjusted value decision program etc. is equivalent to the record medium according to claim 16 to 18.
[0088] Hereafter, defective-part adjusted value decision processing is explained with reference to the flow chart of drawing 3 . At step 100, the image data and IR data of R, G, and B of a single image (image of a processing object) which were inputted into the control section 42 are incorporated in RAM48 grade, and chromatic-aberration-of-magnification amendment which amends a gap of the pixel location on each data of R, G, B, and IR resulting from the chromatic aberration of magnification of the lens 28 of a film scanner 12 is performed to the image data and IR data which were incorporated in the following step 101.
[0089] Chromatic-aberration-of-magnification amendment For example, measure beforehand the change direction and variation (the amount of chromatic aberration of magnification) of a pixel location of a non-criteria wavelength region (for example, R, B, IR) to the pixel location of the criteria wavelength region (for example, G) in each location on the image resulting from the chromatic aberration of magnification of a lens 28, and it memorizes as chromatic-aberration-of-magnification amendment data. It is considered that the value for every pixel which the data of a non-criteria wavelength region expresses is a value in the location where only the variation which chromatic-aberration-of-magnification amendment data expresses shifted in the change direction which chromatic-aberration-of-magnification amendment data expresses to an original pixel location. It accomplishes by performing calculating the value in an original pixel location respectively to each data of a non-criteria wavelength region.
[0090] Defective-part detection processing in which the defective part of the image of the processing object which the image data of R, G, and B expresses with step 102 based on the

image data and IR data of R, G, and B which were incorporated in the RAM48 grade is detected is performed. In advance of explanation of defective-part detection processing, the principle of detection by IR light of the part where the blemish and the foreign matter are attached to the photographic film is explained first.

[0091] As shown in drawing 4 (A), the amount of transmitted lights when irradiating light in the part where the surface on a photographic film has neither the blemish nor the foreign matter decreases only the magnitude of attenuation according to the absorption of light by the photographic film to the amount of incident light to a photographic film. In addition, the wavelength region which the absorption of light produces with a photographic film is a light region about, and since it is hardly absorbed about IR light of an infrared region, it is only that the amount of transmitted lights at the time of irradiating IR light in the part where said blemish or foreign matter are not attached changes from the amount of incident light slightly.

[0092] Since a part of irradiated light is refracted by the blemish on the other hand when light is irradiated in the part where it has the blemish on a photographic film The amount of transmitted lights when irradiating light in the part where it has said blemish (quantity of light of the light which penetrates said part linearly) decreases only the magnitude of attenuation which added attenuation resulting from the optical refraction by the blemish to attenuation resulting from the absorption of light by the photographic film mentioned above to the amount of incident light to a photographic film. In addition, although drawing 4 (A) shows the case where it has the blemish in the incidence side of light, it is also the same as when it has the blemish in the injection side of light.

[0093] The amount of transmitted lights of IR light at the time of irradiating IR light in the part where it has said blemish, since the optical refraction by the blemish also produced IR light decreases only the magnitude of attenuation according to attenuation resulting from the optical refraction by the blemish. In addition, as the optical refraction by the blemish is shown in drawing 4 (B) as an example, it is that from which the scales (depth etc.) of a blemish follow on becoming large, and become remarkable (the same is said of light and IR light), and the amount of transmitted lights at the time of irradiating IR light in the part where it has said blemish becomes small as the scale of a blemish becomes large. Therefore, based on the magnitude of attenuation of the amount of transmitted lights of IR light, the scale of the blemish which it has in the photographic film is also detectable.

[0094] Moreover, although it is dependent also on the magnitude and the class (light transmittance) of foreign matter since the irradiated light is reflected by the foreign matter when light is irradiated in a part with foreign matters, such as dust on a photographic film, the amount of transmitted lights of the light at the time of irradiating light in a part with said foreign matter is greatly decreased with said foreign matter. Attenuation of the amount of transmitted lights at the time of irradiating light in a part with a foreign matter is also the same as when IR light is irradiated in said part.

[0095] As mentioned above, though it changed only in the part with the blemish or foreign matter on a photographic film and the image was recorded on the photographic film, since the amount of transmitted lights at the time of penetrating IR light to a photographic film is not influenced by the transmission density of this image of change, it is irradiating IR light at a photographic film and detecting the amount of transmitted lights, and can detect the blemish and foreign matter which are attached to the photographic film.

[0096] Based on the above, at step 102, as it is the following, defective-part detection processing is performed. The amount of transmitted lights when irradiating IR light at a photographic film falls only in the part where the blemish or the foreign matter is usually attached to the abbreviation fixed next door and the photographic film irrespective of the location on an image as mentioned above (refer to drawing 5). Since IR data expresses the amount of transmitted lights of IR light in each location on the image of a processing object, let the amount of transmitted lights of IR light which IR data in the part where the blemish or foreign matter on the image of a processing object are not attached expresses (for example, maximum of the amount of transmitted lights) be a reference value. And as compared with a reference value, the variation [as opposed to a reference value for the amount of transmitted lights of IR

light] (the amount of falls) of the amount of transmitted lights detects altogether the pixel beyond a predetermined value (value defined in consideration of fluctuation of the some of the amount of transmitted lights of IR light in the part where neither the blemish nor the foreign matter is attached) as a defective pixel belonging to the defective part for correction for every pixel.
[0097] Moreover, at step 102, the detected defective pixel is classified for every defective pixel belonging to the same defective part based on the physical relationship between defective pixels (for example, does it adjoin or not?) etc., and the information (for example, information, such as information showing the defective pixel belonging to each defective part and the amount of falls of the amount of transmitted lights of IR light in each defective pixel) about each defective part is memorized in RAM48 grade. Step 102 supports the detection means (in detail detection means according to claim 2) of this invention with the film scanner 12 which measures the amount of transmitted lights of IR light of a photographic film.
[0098] At step 104, the single defective part of a processing object is chosen from the defective parts detected by defective-part detection processing of step 102. With this operation gestalt, the interpolation method and the brilliance-control method are prepared as the correction method for correcting a defective part, and the predetermined characteristic quantity for choosing any shall be applied to correction of this defective part between the interpolation method and the brilliance-control method to the defective part of the selected processing object (or applicability of both correction methods decision) is calculated in the following step 106. The characteristic quantity which expresses correlation of the concentration change (change of the amount of transmitted lights) of R, G, and B in near a defective part as this predetermined characteristic quantity, for example can be used.
[0099] As shown in drawing 4 (B), the emulsion layer of a photographic film is constituted including each sensitization layer of R, G, and B, the negative image of C is formed in R sensitization layer, the negative image of M is formed in the sensitization layer of G, and, as for the photographic film (negative film) with which exposure record of the image was carried out, and processing of development etc. was performed, the negative image of Y is formed in the sensitization layer of B. And about R light, only the magnitude of attenuation according to the transmission density of the negative image of C is decreased in R sensitization layer among the lights which penetrated the photographic film (absorption). About G light, only the magnitude of attenuation according to the transmission density of the negative image of M is decreased in G sensitization layer (absorption), and only the magnitude of attenuation according to the transmission density of the negative image of Y is decreased in B sensitization layer about B light (absorption).
[0100] As shown in drawing 4 (B) as an example, when it has the blemish in the emulsion side and the back side of the opposite side here, the ratio of the absorption of light in each sensitization layer of R, G, and B to the transmitted light is the same as the case where it does not have the blemish. Namely, R light when it does not have I0 and a blemish in the amount of incident light to a photographic film in drawing 4 (B), the amount of transmitted lights of G light and B light — each I0R, I0G, and I0B ** — the quantity of light which is carried out, penetrates linearly the part where it has the blemish when a blemish is attached, and carries out incidence to an emulsion layer — I1 (a decreased part of a light according [I1<I0:I0−I1] to a blemish) — the amount of transmitted lights of R light when it has the blemish, G light, and B light — each I1R, I1G, and I1B ** — if it carries out, the relation of the following (1) types will be realized.
I0 R/I0**I1 R/I1 I0 G/I0**I1 G/I1 I0 B/I0**I1 B/I1 — (1)
[0101] Thus, when it has the blemish in the back side, the amount of transmitted lights of R light in the part where it has the blemish, G light, and B light falls rather than the time of not having the blemish at all (the same is said of the amount of transmitted lights of IR light). (1) Since the color information on an image that only brightness changes and the defective part corresponding to the part where it has the blemish in the back side is recorded on the photographic film as compared with the case where it does not have the blemish is saved so that more clearly than a formula, the defective part of an image which image data expresses is correctable by applying the brilliance-control method and adjusting the brightness of a defective-part field.

[0102] On the other hand, as shown in drawing 4 (C) as an example, when it has the blemish in the emulsion side, the ratio of the absorption of light in each sensitization layer of R, G, and B to the transmitted light changes with the case where it does not have the blemish, by what some sensitization layers of each sensitization layer (pigment layer) will be deleted for if it is a shallow blemish (damage is received). Moreover, if it is the very deep blemish by which each sensitization layers of all are stripped off, the absorption of light in each sensitization layer to the transmitted light will not be produced. Therefore, as for the relation of (1) type, neither of the cases is materialized.
[0103] In addition, also when it has the blemish in the emulsion side, the amount of transmitted lights of IR light in the part where it has the blemish falls rather than the time of not having the blemish at all. When it has the blemish in the emulsion side, on the other hand, about R light, G light, and B light Although the amount of transmitted lights falls about the light of the wavelength region corresponding to the sensitization layer which has not received damage among R, G, and B, and it depends for damage on the degree of attenuation of the light by the blemish etc. about the light of the wavelength region corresponding to a carrier beam sensitization layer, generally the amount of transmitted lights increases.
[0104] Thus, since the color information on the image which brightness and a color are changing respectively and is recorded on the photographic film is also lost as compared with the case where it does not have the blemish irrespective of the depth of a blemish, even if the defective part corresponding to the part where it has the blemish in the emulsion side adjusts brightness, it is difficult to correct a defective part with a sufficient precision. For this reason, the correction method (the interpolation method) that interpolation determines the brightness and concentration of a defective part from the information on the field around a defective part is suitable for correction of the defective part corresponding to the part where it has the blemish in the emulsion side. In addition, since brightness and a color change respectively as compared with the case where the foreign matter is not attached, also about the defective part which originated in the foreign matter being attached to the photographic film, and was produced, the interpolation method is suitable also when correcting the above-mentioned defective part.
[0105] As mentioned above, in the defective part resulting from the blemish attached to the back side of a photographic film Since the light of each wavelength region of R, G, and B falls at a rate of abbreviation regularity in each part in a defective part Since said rate is unfixed in the defective part which originates in the blemish attached to the emulsion side of a photographic film, or a foreign matter to the concentration variation of R, G, and B in the defective part on image data serving as abbreviation regularity, said concentration variation also serves as an indeterminate. Therefore, it becomes possible, if the characteristic quantity which expresses correlation of the concentration change of R, G, and B in a defective part as predetermined characteristic quantity is used the defective part resulting from the blemish or the foreign matter attached to the defective part which originates in the blemish to which the defective part of a processing object was attached to the back side based on the result of an operation of this characteristic quantity, or (whether it is the defective part which should be corrected by the brilliance-control method) and an emulsion side, or to judge (whether it is the defective part which should
[0106] In addition, it may replace with the characteristic quantity showing correlation of the concentration change of R, G, and B in a defective part, and the characteristic quantity showing correlation with change of the amount of transmitted lights of IR light in near a defective part and change of the amount of transmitted lights of R light in near a defective part, G light, and B light may be used. The gain GainX which can be found from (4) types mentioned later is specifically used as characteristic quantity showing said correlation. Gain GainX is respectively calculated about all the defective pixels belonging to the defective part of a processing object. If all the results of an operation are in a predetermined numerical range (for example, 0.6-1.5) as for close, will judge that correlation is strong and the brilliance-control method will be chosen. Or the application rate of the brilliance-control method is made high, and as long as there is a defective pixel which is not in predetermined numeric-value within the limits, it judges that correlation is weak and may be made to make high the application rate of selection or the

interpolation method for the interpolation method.
[0107] Moreover, the surrounding edge reinforcement and the texture reinforcement in a field of a defective part may be used as predetermined characteristic quantity. That is, since interpolation is performed from the concentration change in a perimeter field on the assumption that the interpolation method is changing smoothly [the concentration of the original image], and continuously in the perimeter field of a defective part within a defective part, in the edge with high edge reinforcement having existed, for example in the perimeter of a defective part etc., the precision of a interpolation operation falls, and it becomes difficult to correct a defective part with a sufficient precision. Therefore, if the edge reinforcement in the field around a defective part is used as predetermined characteristic quantity, it will become possible to judge the defective part which the defective part of a processing object should correct by the brilliance-control method, or the defective part which should be corrected by the interpolation method based on the result of an operation of this characteristic quantity. It can ask for the edge reinforcement in the field around a defective part from the concentration distribution in the perimeter field of a defective part.
[0108] Moreover, since it is distinguished as an image field where the portions from which a texture differs in observation of the image with which the texture exists differ, it is very conspicuous also when correction of the defective part to which the clear texture exists in the perimeter field of a defective part goes wrong. The brilliance-control method that dispersion in the correction precision of a defective part is comparatively small is suitable also for correction of such a defective part. Therefore, if the texture reinforcement in the field around a defective part is used as predetermined characteristic quantity, it will become possible to judge the defective part which the defective part of a processing object should correct by the brilliance-control method, or the defective part which should be corrected by the interpolation method based on the result of an operation of this characteristic quantity.
[0109] in addition, the gray level histogram of the common knowledge which is the typical count method of a statistical textural facility as texture reinforcement of the perimeter field of a defective part, for example, a coincidence occurrence (co-occurrence) matrix, and difference -- the statistic calculated using at least one of a statistic, a run length matrix, power spectrums, etc. can be used, and the above-mentioned statistic can be calculated from the concentration distribution in the perimeter field of a defective part.
[0110] Furthermore, you may use whether the defective part exists in the principal part field in an image as predetermined characteristic quantity (or duplication rate of a defective part and a principal part field). That is, since the principal part field in an image (for example, field equivalent to a person's face) is a field which attracts attention in appreciation of an image etc., the brilliance-control method that dispersion in the correction precision of a defective part is comparatively small is suitable for correction of the defective part which exists, for example in a principal part field, or the defective part which overlaps the principal part field. therefore, a ****** [that the defective part exists in the principal part field in an image as predetermined characteristic quantity] -- or if the duplication rate of a defective part and a principal part field is used, it will become possible to judge the defective part which the defective part of a processing object should correct by the brilliance-control method, or the defective part which should be corrected by the interpolation method based on the result of an operation of this characteristic quantity.
[0111] Moreover, the amount of transmitted lights of IR light in near a defective part may be used as predetermined characteristic quantity. That is, since the big defective part (for example, defective part corresponding to a big blemish, a foreign matter, or the foreign matter that has neither a deep blemish nor light transmission nature) of a scale is conspicuous when a correction result serves as unsuitable positive, the brilliance-control method that dispersion in the correction precision of a defective part is comparatively small is suitable for correction of such a defective part. Since the scale of a defective part can be judged from the amount of transmitted lights of IR light in near a defective part, or its change, if the amount of transmitted lights of IR light (or characteristic quantity showing the scale of the defective part which can be found from the amount of transmitted lights of IR light) is used, based on the result of an operation of

predetermined characteristic quantity, it will become possible as predetermined characteristic quantity to judge the defective part which the defective part of a processing object should correct by the brilliance-control method, or the defective part which should be corrected by the interpolation

[0112] In addition, in step 106, it cannot be overemphasized that two or more sorts of characteristic quantity may be calculated from various kinds of characteristic quantity mentioned above as predetermined characteristic quantity.

[0113] If predetermined characteristic quantity is calculated as mentioned above, at the following step 108, the applicability of each correction method in the case of choosing the interpolation method or the brilliance-control method as the correction method applied to correction of the defective part of a processing object based on the result of an operation of predetermined characteristic quantity, or applying the interpolation method and the brilliance-control method to correction of the defective part of a processing object respectively (application rate) will be determined. In addition, step 108 supports the decision means (in detail decision means according to claim 3 or 4) of this invention with step 106 explained previously.

[0114] Selection of the correction method in step 108 to apply or the decision of the applicability of the correction method can be made by using the map showing the value of predetermined characteristic quantity, and relation with the application rate alpha of the interpolation method (the application rate of the brilliance-control method being sufficient), as shown in drawing 6 (A). In addition, in the map of drawing 6 (A), the range of alpha= 1 chooses only the interpolation method, a defective part is corrected, the range of alpha= 0 means choosing only the brilliance-control method and correcting a defective part, and in 0< alpha<1, the interpolation method is application rate =alpha and it is respectively applied by application rate = (1-alpha) of the brilliance-control method. By determining selection / application rate of the correction method as mentioned above according to the value of the predetermined characteristic quantity calculated at step 106, the correction method which should be applied will be chosen or the optimal application rate of each correction method will be determined so that the defective part of a processing object may be corrected with a sufficient precision.

[0115] In addition, in step 108, a map as replaced with the map of drawing 6 (A) and shown in drawing 6 (B) and drawing 6 (C) may be used. Since which value of 0 or 1 is set as the application rate alpha on the map of drawing 6 (B), either the interpolation method and the brilliance-control method are chosen as the correction method. Moreover, on the map of drawing 6 (C), in almost all cases, the value of the application rate alpha is set to 0< alpha<1, and the interpolation method and the brilliance-control method are respectively applied as the correction method. In addition, the map from which the value of the application rate alpha changes nonlinear to the value change of characteristic quantity may be used.

[0116] At the following step 110, it judges whether the interpolation method is applied to correction of the defective part of a processing object. Although a judgment will be denied and it will shift to step 114 if it is the application rate alpha= 0, if it is the application rate alpha!=0, a judgment will be affirmed, it will shift to step 112, and adjusted value decision processing by the interpolation method is performed. Hereafter, the adjusted value decision processing by this interpolation method is explained with reference to the flow chart of drawing 7 .

[0117] At step 150, a defective pixel single out of each defective pixel belonging to the defective part of a processing object as a defective pixel of a processing object is chosen, and the scanning direction (the retrieval direction) is initialized at the following step 152. In the adjusted value decision processing by the interpolation method concerning this operation gestalt, as two or more arrow heads show to drawing 8 as an example, it scans respectively along two or more directions which extend in a radial from the defective pixel of a processing object, and each characteristic quantity and the interpolation value of a concentration gradient and the distance between normal pixels are respectively calculated about each direction (it mentions later for details). initialization in previous step 152 — two or more directions — it accomplishes by setting up an inner predetermined one direction as a current scanning direction (the first scanning direction).

[0118] Interpolation operation part is initialized at the following step 154. Interpolation operation

part is a subroutine which performs the operation of the above-mentioned concentration gradient, the distance between normal pixels, and a interpolation value based on the inputted data, is respectively prepared for every color of R, G, and B, and performs the above-mentioned operation separately for R, G, and B each color of every while it will hold the inputted data, if the data of a normal pixel (pixel which does not belong to a defective part) is inputted. Initialization in step 154 is accomplished by clearing the data currently held at each interpolation operation part.

[0119] At step 156, it exists in the direction which corresponds in the current scanning direction to the defective pixel of a processing object as the address of the pixel which should be referred to, and the distance on an image judges the address of a defective pixel to the nearest un-reference pixel (pixel which adjoins in the current scanning direction to the defective pixel of a processing object at first).

[0120] In addition, this operation gestalt defines the direction in alignment with the straight line prolonged through the pixel of a processing object as a scanning direction, as shown in drawing 8 , but since an actual scan is scanned in the direction which keeps away from the pixel of a processing object along with said straight line, two scans from which the 180 degrees of the scanning directions differ about the single scanning direction are performed (the scan of each time is called the positive direction and the negative direction for convenience). For this reason, at previous step 156, the detailed current scanning direction judges the positive direction or the negative direction (when the scanning direction is set up, a positive negative direction is also initialized), and judges the address of the un-reference pixel which exists in the judged direction.

[0121] At step 158, each data of R, G, B, and IR of the pixel (reference pixel) of the address judged at step 156 is incorporated. At the following step 160, a reference pixel judges whether it is a defective pixel based on IR data incorporated at step 158. In addition, it replaces with referring to IR data, labeling of all the pixels in an image is carried out according to the defective pixel or the normal pixel in defective-part detection processing (step 102 of the flow chart of drawing 3), and it may be made to perform said judgment by referring to a labeling result.

[0122] When the judgment of step 160 was affirmed, in spite of having shifted to step 162 and having scanned beyond fixed distance, it judges whether the normal pixel was detected. When this judgment is denied, the processing and the judgment after return and step 156 (scan which met in the same scanning direction) are repeated by step 156.

[0123] In step 160, when a reference pixel is a normal pixel, a judgment is denied and it shifts to step 164, and the data of R, G, and B of a reference pixel incorporated at previous step 158 is respectively inputted into interpolation operation part. In addition, the inputted data is respectively held by interpolation operation part. At the following step 166, it judges whether the normal pixel more than fixed numbers was referred to. When a judgment is denied, the scan to return and the same direction is repeated to step 156.

[0124] Moreover, if the normal pixel more than fixed numbers is referred to (the data of the normal pixel more than fixed numbers is inputted into interpolation operation part), the judgment of step 166 will be affirmed, and it will shift to step 168, and will judge whether the scan to the positive direction and the negative direction was performed respectively to the current scanning direction. When a judgment is denied, after shifting to step 170 and changing the positive/negative of the scanning direction, it returns to step 156. By this, a scan will be performed along the scanning direction different 180 degrees from last time.

[0125] If the normal pixel more than fixed numbers is respectively referred to with the scan of the positive direction and the negative direction to the current scanning direction, the judgment of step 166 and step 168 will be affirmed respectively, and will shift to step 172. At this time, the data of a fixed number of normal pixels (normal pixel shown in drawing 9 (A) by "-") is inputted respectively, and interpolation operation part is in the condition in which an operation in operation precision is [beyond a constant level] possible of being located in the both sides of a defective part along the scanning direction on both sides of a defective part at interpolation operation part.

[0126] For this reason, interpolation operation part is made to perform the interpolation operation of the pixel value (R, G, the concentration value for B each color of every, value shown

in drawing 9 (A) by "**") of a defective pixel at step 172. This interpolation operation can be performed with the application of a least square method etc. And while incorporating the interpolation value VALUEX of the pixel value of the defective pixel of a processing object (i) (however, i is a sign for identifying the scanning direction, and X expresses any of R, G, and B they are) as the result of an operation The distance DIST between inclination (absolute value) GRAD[of the concentration gradient calculated in process of the interpolation operation] (i) normal pixels (i) and the (drawing 9 (A) reference) are incorporated, and the incorporated data is memorized.

[0127] At the following step 174, it judges whether it scanned about all the scanning directions. When a judgment is denied, after changing the scanning direction current at step 176, it returns to step 154. By this, the interpolation value VALUEX of the pixel value of the defective pixel of a processing object (i), inclination GRAD (i) of a concentration gradient, and the distance DIST between normal pixels (i) will be respectively calculated and memorized about two or more predetermined, scanning directions.

[0128] In addition, since a normal pixel is not detected even if it scans beyond fixed distance when the scanning direction is carrying out abbreviation coincidence like the "direction 6" shown in drawing 8 with the direction where a defective part (white field in drawing 8) is prolonged, the scan about this scanning direction is stopped by the judgment of step 162 being affirmed and shifting to step 174. Thereby, the processing time can be shortened.

[0129] In addition, the above-mentioned step 152 - step 176 support the characteristic quantity operation means according to claim 8 and the individual adjusted value operation means (in detail claim 9, a characteristic quantity operation means according to claim 10, and an individual adjusted value operation means) with interpolation operation part.

[0130] If a scan is completed about all the scanning directions, the judgment of step 174 will be affirmed, it will shift to step 178, and the weighting factor for every scanning direction will be calculated based on inclination GRAD (i) of the concentration gradient calculated and memorized for every scanning direction, and the distance DIST between normal pixels (i). With this operation gestalt, weighting-factor [for every scanning direction] M (i) is calculated according to the following (2) types.

M(i) =Mg(GRAD (i)) xMd (DIST (i)) -- (2)

[0131] In addition, in (2) types, Mg and Md are weighting factors, and when inclination GRAD of a concentration gradient is small, weighting-factor Mg can be defined according to inclination GRAD of a concentration gradient using a map as shown in drawing 9 (B) as an example so that weight may become large. Moreover, when the distance DIST between normal pixels is small also about weighting-factor Md, according to the distance DIST between normal pixels, it can set using a map as shown in drawing 9 (C) as an example so that weight may become large.

[0132] About the scanning direction where inclination GRAD of a concentration gradient is small and where the distance DIST between normal pixels is small, the value of weighting-factor M becomes large by this, and the value of weighting-factor M will be made small about the scanning direction where inclination GRAD of a concentration gradient and either of the distance DIST between normal pixels are large (or 0). Moreover, about the scanning direction where the scan was stopped by the judgment of step 162 being affirmed, the value of weighting-factor M is unconditionally set to 0.

[0133] At the following step 180, the correction pixel value DIX of the defective pixel of a processing object is calculated to every R, G, and B according to the following (3) types based on the interpolation value VALUEX for every scanning direction (i), and weighting-factor M (i).

DIX=sigma(M(i) xVALUEX (i))/sigma (M (i)) -- (3)

[0134] (3) Since weighting of the interpolation value VALUEX for every scanning direction (i) is carried out according to weighting-factor M (i) and the correction pixel value DIX is calculated, though the proper scanning direction differs in the formula for every portion in each defective part of every and a single defective part, a proper correction pixel value can be acquired. In addition, the above-mentioned steps 178 and 180 support the last adjusted value operation means according to claim 8.

[0135] At the following step 182, it judges whether the above-mentioned processing was

performed to all the defective pixels in the defective part of a processing object. When a judgment is denied, the processing after step 150 is repeated for return and the correction pixel value DIX to a non-calculated defective pixel to step 150. And affirmation of the judgment of step 182 ends the adjusted value decision processing by the interpolation method.

[0136] After ending adjusted value decision processing according to the interpolation method as mentioned above, it shifts to step 114 of the flow chart of drawing 3 . At step 114, it judges whether the brilliance-control method is applied to correction of the defective part of a processing object. Although a judgment will be denied and it will shift to step 118 if it is the application rate alpha= 1, if it is the application rate alpha!=1, a judgment will be affirmed, it will shift to step 116, and adjusted value decision processing by the brilliance-control method is performed. Hereafter, the adjusted value decision processing by this brilliance-control method is explained with reference to the flow chart of drawing 10 .

[0137] the part which contains the defective part of a processing object at step 200 from the image data and IR data (data after chromatic-aberration-of-magnification amendment) of R, G, and B of a processing object -- the data of a field (for example, field which consists of the defective part and its perimeter field of a processing object) is extracted respectively. [of an image] The following step 202 generates respectively high frequency component data H-r of R, high frequency component data H-g of G, high frequency component data H-b of B, and high frequency component data H-IR of IR from each data of R, G, B, and IR in inputting each extracted data into a high-pass filter respectively.

[0138] At the following step 204, a defective pixel unsettled as a defective pixel of a processing object is chosen from each defective pixels belonging to the defective part of a processing object, and high frequency component data h-r of said selected defective pixel, h-g, h-b, and h-IR are respectively extracted from high frequency component data H-r, H-g, H-b, and H-IR. At the following step 206, the ratio (gain GainX:, however X express any of R, G, and B they are) of the high frequency component of R, G, B, and IR of the defective pixel of a processing object is calculated according to the following (4) types.

GainX=h-x/h-IR -- (4)

In addition, high frequency component data h-r, h-g, h-b, and h-IR from which the dc component and the low-frequency component were removed by the above-mentioned (4) formulas are used. Since it is asking for the ratio of high frequency component data h-r, h-g, and h-b and high frequency component data h-IR as gain GainX, this gain GainX The ratio of the amount of transmitted lights of the light of each wavelength region of R, G, and B in a photographic film, the light of each wavelength region of R, G, and B resulting from a difference of the rate of IR optical refraction, and IR light is expressed.

[0139] At step 208, the data Dr, Dg, Db, and ir of the defective pixel of a processing object is respectively extracted from each data of R, G, B, and IR. And at step 210, the correction pixel value DGX of the defective pixel of a processing object is calculated according to the following (5) types based on the gain GainX calculated at step 206.

DGX=DX-irxGainX -- (5)

(5) Since the 2nd term of a formula has amended Data ir using the gain GainX showing the ratio of the amount of transmitted lights of the light of each wavelength region of R, G, and B in a photographic film, the light of each wavelength region of R, G, and B resulting from a difference of the rate of IR optical refraction, and IR light It becomes the value which expresses correctly the variation of the amount of transmitted lights of R light in the defective pixel location of the processing object resulting from the blemish which it has in the photographic film, G light, or B light (logarithm value). And since, as for (5) types, only (irxGainX) has changed the pixel value of a defective pixel, the value which amended correctly change of the amount of transmitted lights of R light which originates in the blemish which it has in the photographic film as a correction pixel value DGX, G light, or B light can be acquired. In addition, step 200 mentioned above - step 210 support the operation means according to claim 11.

[0140] At the following step 212, it judges whether the above-mentioned processing was performed to all the defective pixels belonging to the defective part of a processing object. When a judgment is denied, the processing after return and step 204 is repeated to step 204. And

affirmation of the judgment of step 212 ends the adjusted value decision processing by the brilliance-control method.

[0141] After ending adjusted value decision processing according to the brilliance-control method as mentioned above, it shifts to step 118 of the flow chart of drawing 3 , and the adjusted value to the defective part of a processing object is determined. The adjusted value to the defective part in this operation gestalt can determine the adjusted value to the defective part of a processing object by setting up respectively the correction pixel value determined by the interpolation method or the brilliance-control method as a correction pixel value of each defective pixel belonging to the defective part of a processing object, when it consists of the correction pixel value of each defective pixel belonging to said defective part and applies either the interpolation method and the brilliance-control method to correction of the defective part of a processing object.

[0142] When applying the interpolation method and the brilliance-control method to correction of the defective part of a processing object respectively, moreover, the adjusted value to the defective part of a processing object When the application rate of DGX and the interpolation method is set to alpha, the correction pixel value determined by DIX and the brilliance-control method in the correction pixel value determined by the interpolation method Correction pixel value D0X of each defective pixel belonging to the defective part of a processing object can be determined by calculating respectively by the following (6) types.

D0 X=alphaxDIX +(1-alpha) xDGX — (6)

The above can determine the adjusted value to the defective part of a processing object so that the defective part of a processing object may be corrected with a sufficient precision. Step 118 supports claim 1, claim 8, and the correction means according to claim 11.

[0143] At the following step 120, it judges whether processing after step 104 was performed to all the defective parts detected by defective-part detection processing (step 102). When a judgment is denied, the processing after step 104 is repeated for return and other unsettled defective parts as a defective part of a processing object to step 104. By this, the operation of predetermined characteristic quantity, selection of the correction method based on the result of an operation which should be applied or the decision of applicability (application rate), and the decision of an adjusted value will be respectively made to all the defective parts detected by defective-part detection processing.

[0144] If an adjusted value is respectively determined to all the detected defective parts, the judgment of step 120 will be affirmed, it will shift to step 122, the adjusted value to each defective part will be notified to an image processor 40 with the information (for example, address of the defective pixel which constitutes each defective part) showing the location of a defective part, and defective-part adjusted value decision processing will be ended.

[0145] In an image processor 40, defective-part (value of each defective pixel which belongs to defective part in detail is transposed to correction pixel value to which it was notified) correction processing in which a defective part is corrected according to the adjusted value notified from the control section 42 by defective-part adjusted value decision processing being performed by the control section 42 is performed to fine scan image data. Thus, the image processor 40 also supports claim 1, claim 8, and the correction means according to claim 11.

[0146] Moreover, an image processor 40 performs various kinds of image processings on the processing conditions determined by the setup operation in a control section 42 to the image data which performed defective-part correction processing, and outputs them to a printer 16 through I/O controller 38 and the I/F circuit 54. Thereby, the defective part chosen as a candidate for correction is eliminated from the image by which exposure record is carried out by printing paper 68.

[0147] In addition, although the interpolation method and the brilliance-control method were explained as an example of two or more sorts of correction methods which start this invention above, it is not limited to this, the so-called method of obscuring of obscuring a defective part by covering a low pass filter etc. may be added, and you may make it choose no correcting (a defective part not being corrected) depending on the value of the predetermined characteristic quantity of the defective part of a processing object.

[0148] Moreover, although predetermined characteristic quantity, such as characteristic quantity which expresses correlation of the concentration change of R, G, and B in a defective part with the above, was calculated and the application rate alpha was determined based on the result of an operation Not the thing limited to this but the amount of transmitted lights of the light of each wavelength region of R, G, B, and IR in a defective part, The amount of transmitted lights of the light of each wavelength region of R, G, B, and IR in the field around a defective part, It compares, and when the amount of transmitted lights of the light of at least one wavelength region is increasing among R, G, and B, you may make it any light of a wavelength region choose the brilliance-control method, when the amount of transmitted lights is falling, and choose the interpolation method. Choosing the correction method as mentioned above supports invention of claim 6 and claim 7.
[0149] Moreover, although it was performing respectively calculating a concentration gradient and the distance between interpolation pixels about each direction, and determining the weight of each direction in the adjusted value decision processing (drawing 7) by the interpolation method about all the defective pixels belonging to a defective part in the above As opposed to not the thing limited to this but all the defective pixels belonging to a single defective part May be made to calculate the last interpolation value of each defective pixel using the value same as weight of each direction (for example, the weight of each direction searched for about the pixel located in the location equivalent to the center of a defective part or a center of gravity is used common to all the defective parts belonging to a single defective part).
[0150] Moreover, although Gain GainX was used as characteristic quantity which expresses a difference of the refractive index of the light in an image recording material and the non-light with the above in the adjusted value decision processing (drawing 10) by the brilliance-control method A difference of the refractive index for every wavelength of the light in not the thing limited to this but a photographic film Since it becomes settled about according to the quality of the material of the film base of a photographic film For example, measure beforehand a difference of the refractive index in each wavelength region of R, G, and B and the wavelength region of IR light in every film type (135 sizes / 240 sizes / --), and it memorizes as data. The film type of a photographic film may be detected, corresponding data may be read, and you may use for the operation of (5) types etc.
[0151] Furthermore, although the configuration which reads an image by the area sensor (area CCD 30) by which the photo-electric-conversion cel was arranged in the shape of a matrix as an example of an image reader which reads the image currently recorded on the photographic film above was explained, it is not limited to this and you may make it read an image with the line sensor by which the photo-electric-conversion cel was arranged in the shape of Rhine. Moreover, although the configuration which reads an image by carrying out photo electric conversion of the light which penetrated the photographic film above was explained, it is not limited to this and the configuration which reads an image by carrying out photo electric conversion of the light which reflected the photographic film may be adopted.
[0152] Moreover, although the example which reads R, G, and B above at the time of a press can, and reads R, G, B, and IR at the time of a fine scan was explained, it is not limited to this, and IR reading may be performed only at the time of a press can, and is respectively good in a line at the time of a press can and a fine scan.
[0153] Moreover, although the case where the defective part resulting from the blemish attached to the photographic film above or a foreign matter was corrected was explained, this invention is not limited to this. For example, when the defective pixel exists in optoelectric transducers, such as CCD prepared in the film scanner, the digital camera, etc., the defective part resulting from a blemish or a foreign matter and the same defective part arise in the image which the image data obtained by picturizing an image or a photographic subject expresses. This invention may be applied to correction of the defective part resulting from this pixel defect, and selection of the optimal correction method or applicability of each correction method may be determined according to the characteristic quantity of each defective part.
[0154] Detecting the defective part which originates in a defective pixel for example, at the time of equipment manufacture can detect the defective part resulting from a pixel defect by reading

the information which memorizes the information for specifying the defective pixel of the optoelectric transducer discovered by inspection to ROM with built-in equipment etc. at the time of manufacture of an image processing system, and was memorized by ROM etc. moreover -- for example, if it is the film scanner of a configuration (for example, configuration which is made to rotate a turret and reads light of each wavelength region one by one) of that a single optoelectric transducer performs respectively photo electric conversion (reading) of the light and IR light, detection of the defective part of the image resulting from the pixel defect of an optoelectric transducer can also be carried out by comparing the reading result of the light with the reading result of IR light
[0155]
[Effect of the Invention] As explained above, claim 1 and invention according to claim 13 [whether based on the characteristic quantity of the defective part of an image which image information expresses, the correction method which should be applied to correction of a defective part is chosen from two or more sorts of correction methods, and] Or each applicability of the two or more correction methods applied to correction of a defective part is determined. It is in the applicability which the defective part was corrected [applicability] with the application of the selected correction method to image information, or had the two or more correction methods determined, and since it applies respectively and a defective part is corrected, it has the outstanding effect of becoming possible to correct various defective parts with a sufficient precision respectively.
[0156] Since invention according to claim 2 detected the defective part of an image from the result of having carried out photo electric conversion of the non-light which irradiated the non-light, and penetrated or reflected the image-recording material to the image-recording material with which the image was recorded in invention of claim 1, it has the effect that the defective part resulting from the blemish or the foreign matter attached in the image-recording field of an image-recording material is certainly detectable in addition to the above-mentioned effect.
[0157] Correlation of the concentration change [in / on invention of claim 1, and / in invention according to claim 3 / near a defective part] for every component color, Since selection of the correction method or the decision of applicability is made using at least one of the duplication rates with the principal part field of whether distribution of the concentration in the field around a defective part and a defective part exist in a principal part field, and a defective part In addition to the above-mentioned effect, it has the effect that selection of the correction method or the decision of applicability can be made with a sufficient precision.
[0158] Since invention according to claim 4 makes selection of the correction method, or the decision of applicability in invention of claim 2 using either [at least] transparency of the non-light in near a defective part, and the light or correlation of change of the amount of reflected lights and transparency of the non-light in near a defective part or the amount of reflected lights, in addition to the above-mentioned effect, it has the effect that selection of the correction method or the decision of applicability can be made with a sufficient precision.
[0159] In invention of claim 2, when the non-light and the light of two or more predetermined wavelength regions in a visible region are irradiated respectively at an image recording material, invention according to claim 6 About the light of at least one wavelength region in two or more wavelength regions lower than the amount [in / in the amount of transmitted lights in a defective part / the field around a defective part] of transmitted lights about the non-light Since the interpolation method is chosen as the correction method which should be applied to correction of a defective part when the amount of transmitted lights in a defective part is higher than the amount of transmitted lights in the field of said perimeter It has the effect that the defective part resulting from the blemish which has done damage to the pigment layer is correctable with a sufficient precision in addition to the above-mentioned effect.
[0160] In invention of claim 2, when the non-light and the light of two or more predetermined wavelength regions in a visible region are irradiated respectively at an image recording material, invention according to claim 7 Since the brilliance-control method is chosen as the correction method which should be applied to correction of a defective part when the amount of transmitted lights in a defective part is lower than the amount of transmitted lights in the field

around a defective part about both the non-light and the light of two or more wavelength regions It has the effect that the defective part resulting from the blemish which has not done damage to a pigment layer is correctable with a sufficient precision in addition to the above-mentioned effect.
[0161] While claim 8 and invention according to claim 14 calculate image characteristic quantity along two or more mutually different directions out of the defective part in an image It performs calculating an adjusted value with interpolation from the information on the field which exists in the predetermined direction on an image to a defective part about two or more directions. Since a defective part is corrected in quest of the last adjusted value based on the image characteristic quantity for every direction from the adjusted value for every direction, it has the outstanding effect that dispersion in the correction precision in correction of the defective part by the interpolation method can be controlled.
[0162] Invention according to claim 9 is set to invention of claim 8. As image characteristic quantity Concentration change of the image which met in the predetermined direction, quantity of light change which met in the predetermined direction of the non-light which penetrated or reflected the image recording material, Since or [any] is respectively calculated at least about two or more directions of distance until the normal pixel which does not belong to a defective part appears when an image is followed along the number of the defective pixels which exist on an image in fixed distance along a predetermined direction, and a predetermined direction It has the effect that the image characteristic quantity as which each of two or more directions can estimate correctly whether it is the proper interpolation direction is obtained in addition to the above-mentioned effect.
[0163] In invention of claim 8, since invention according to claim 10 performs respectively calculating image characteristic quantity or an adjusted value in the range until a fixed number of normal pixels which do not belong to a defective part appear about two or more directions when an image is followed along the predetermined direction, it has the effect that the time amount which the operation of image characteristic quantity or an adjusted value takes can be shortened in addition to the above-mentioned effect.
[0164] Transparency or the amount of reflected lights of the non-light in near a defective part when claim 11 and invention according to claim 15 irradiate the non-light to the defective part of an image at an image recording material, The amount of brightness modification is calculated based on a difference of the refractive index of the light in an image recording material and the non-light, and since the brightness of a defective part corrects image information so that only said brightness variation may change, it has the outstanding effect that the correction precision of the defective part by the brilliance-control method can be raised.
[0165] In invention of claim 11, invention according to claim 12 as characteristic quantity showing a difference of the refractive index of the light and the non-light The value which extracted the high frequency component from transparency of the non-light in near a defective part, or change of the amount of reflected lights, Since the characteristic quantity which calculates the ratio of the value and ** which extracted the high frequency component from transparency of the light in near a defective part or change of the amount of reflected lights, or expresses a difference of said refractive index based on the class of image recording material is acquired It has the effect that the amount of brightness modification which can amend correctly transparency of the light resulting from the blemish which it has into the image recording material, or change of the amount of reflected lights can be obtained in addition to the above-mentioned effect.
 [0166] The 1st step to which invention according to claim 16 detects the defective part of an image, The 2nd step which determines each applicability of the two or more correction methods which choose the correction method which should be applied based on the characteristic quantity of a defective part, or are applied, And since the program for making a computer perform processing containing the 3rd step which is in the applicability which corrected the defective part with the application of the selected correction method, or determined the two or more correction methods, applies respectively and corrects a defective part was recorded on the record medium It has the outstanding effect of becoming possible to correct various defective parts with a sufficient precision respectively.

[0167] While invention according to claim 17 calculates image characteristic quantity respectively along two or more mutually different directions out of the defective part in an image The 1st step which performs calculating an adjusted value with interpolation from the information on the field which exists in the predetermined direction on an image to a defective part about two or more directions, The 2nd step which calculates the last adjusted value from the adjusted value for every direction based on the image characteristic quantity for every direction, And since the program for making a computer perform processing containing the 3rd step which corrects a defective part using the last adjusted value was recorded on the record medium, it has the outstanding effect that dispersion in the correction precision in correction of the defective part by the interpolation method can be controlled.
[0168] Transparency or the amount of reflected lights of the non-light in near a defective part when invention according to claim 18 irradiates the non-light to the defective part of an image at an image recording material, The 1st step which calculates the amount of brightness modification based on a difference of the refractive index of the light in an image recording material and the non-light, Since the program for making a computer perform processing in which the brightness of a defective part contains the 2nd step which corrects image information so that only said brightness variation may change was recorded on the record medium It has the outstanding effect that the correction precision of the defective part by the brilliance-control method can be raised.

[Translation done.]